# Series 50 Fetal Monitors
# Series 50 XM (M1350B)
# Series 50 XMO (M1350C)

**SELF-PACED TRAINING PROGRAM**

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# 1

# Self-Paced Training Program

This workbook has been developed to provide introductory, self-paced training for people who service the M1350B/C Fetal Monitor.

## Objectives

- Operate the fetal monitor competently.
- Locate and remove the following sub-assemblies
  - Recorder.
  - Front Panel.
  - System PC Boards.
- Replace the thermal print head.
- Verify correct equipment performance.
- Run the **Parameter Test** and the **Quick Test**.
- Read the Error Log.
- Understand upgrade procedures, or if parts for an upgrade are available, upgrade the following:
  - The M1350A to M1350B/C.
  - Add maternal parameters.
  - Add Fetal $SpO_2$.

## Time Required

This course can be completed in approximately 4 hours.

# Materials and Equipment Required

| | | |
|---|---|---|
| * | 1 | Latest Fetal Monitoring Documentation CD-ROM |
| * | 1 | Latest Philips XM/XMO Fetal Monitor Video Operating Guide (optional). |
| | 1 | VCR of appropriate format. |
| | 1 | Philips Series 50 M1350B/C Fetal Monitor. |
| * | 1 | Packet of Philips recorder paper. |
| * | 1 | Latest Philips Series 50 XM/XMO M1350B/C Service Guide. |
| | 1 | Latest Philips Series 50 XM/XMO M1350B/C User's Guide. |
| | 1 | Personal Computer (optional). |
| * | 1 | Service software and PC cable (M1360-68875). |
| | 1 | Philips Series 50 M1350B/C Fetal Monitor base assembly and/or appropriate options for upgrade (optional). |
| | | Miscellaneous handtools. |
| * | 1 | Successful Course Completion Certificate. |
| * | 1 | Error Reference Card. |
| * | 1 | Self-examination paper and answer sheet. |
| | 1 | ESD workstation or equivalent. |

*Items required to complete training.

# How To Use this Workbook

Follow the steps in the "Procedure" section below. Perform all the tasks and answer each question in each of the sections in the Workbook, then check your answers in the *Workbook Answers and Explanations* section of this workbook, where you will also find supplementary information.

# Procedure

This course should be performed in the following sequence:

1 Review the XM/XMO Fetal Monitor Video Operating Guide. This will introduce you to the uses of, and how to operate, the fetal monitor.

Time required: approximately 25 minutes.

Read the *Service Guide*, General Information, then perform Section 2, "Operation" in this workbook. Answer all the questions and check your answers in the "Workbook Answers and Explanations" section at the back of this workbook.

Time required: approximately 45 minutes.

2 Perform Section 3, "Performance Assurance & Service Tool Testing".

If you have a PC, you should load the service tool software (refer to the *Service Guide*, "Configuring the Monitor", for instructions), and make sure you have a suitable service tool cable (you might need to modify the supplied cable to fit your PC's connector).

Time required: approximately 20 minutes if you are using the Service Tool.

3 Perform Section 4, "Disassembly & Troubleshooting". Refer to the *Service Guide*, "Troubleshooting, Removal and Replacement and Recorder Assembly and Disassembly".

Some information on the theory of operation is included in this section. For further details see *Service Guide*, Theory of Operation.

Tools required: flat blade screwdriver, crosshead screwdrivers (small and large).

Time required: approximately 75 minutes.

4 Perform Section 5, "Transducers & Patient Modules" referring to the *Service Guide*, "Transducers and Patient Monitors", and the *Instructions for Use*, Appendix A.

Time required: approximately 25 minutes.

5 Perform Section 6, "Monitor Settings & On-site Configuration".

Time required: approximately 20 minutes.

6 Perform Section 7, "Upgrades". Refer to the *Service Guide*, Upgrades, for detailed instructions. If you have a fetal monitor and the appropriate options, upgrade the monitor. If not answer the questions in this section of the workbook, referring to the *Service Guide*, "Upgrades", for information as required.

Time required: approximately 50 minutes.

7 Watch the video tape again and review this workbook, then take the course examination. The course examination is included with the training kit.

# 2

# Operation

## References required:

- Series 50 XM/XMO (M1350B/C) User's Guide.
- Series 50 XM/XMO (M1350B/C) Service Guide:

## General Information

Before continuing, make sure that you have watched the *Series 50 XM/XMO Fetal Monitor Video Operating Guide*. Remember to check your responses with the answer sheet.

## Questions and Tasks

1 Record the serial number of the instrument used for this course:
SERIAL # _____

2 Load paper in the recorder section. Note the markings on the paper.
What color is the printing on your paper?

3 Plug in the M1350B/C fetal monitor and press the [Line] key to power on.
When you switch on the monitor it performs a basic self-test. If an error occurs, an error message is displayed on the front panel.

4 What happens to the display on the front panel of the monitor?

5 Set the date and the time to October 12th, 2004, at 1:30pm, using the [ ] key and the [+] and [-] keys to alter the values.
How do you exit from the clock setting function?

6 Set the recorder speed to 3 cm/min using the appropriate function key.
Where is the key located on the front panel?

7 Turn on the recorder and note what is annotated on the strip.

**8** Plug in the M1356A Ultrasound Transducer. Notice that the signal quality indicator is red.

If you are monitoring one fetus, which socket must Ultrasound Transducer be plugged into?

**9** Remove the Ultrasound Transducer and plug in the M1364A patient module with legplate adapter cable M1362B. Which socket should the patient module be plugged into?

You should see **NOP** on the front panel display because no spiral electrode is attached. This is not an error. Refer to the latest *Service Guide* for details.

**10** Select LOGIC OFF by pressing the front panel [F ⚠] key, followed by the [- +] key.

What effect does this have on fetal monitoring?

Turn logic on again (using the [F ⚠] and [- +] keys).

**11** Plug in the MECG transducer M1359A, or patient module M1364A with cable M1363A, into the remaining cardio socket and notice the MECG light up on the front panel.

**12** Plug in the external TOCO transducer M1355A and note the TOCO digit display.

**13** Using the TOCO zeroing button, adjust the TOCO reading to 20. Now press on the TOCO transducer and watch the display.

What is the maximum reading you can see on the TOCO display?

**14** Press the event marker button on the front panel and hold it down for 20 seconds. Note the appearance of a black mark on the strip.

If the paper speed is 3cm/min, the mark will be (3 x 20)/60cm long; or 1 cm long.

How else can an event be marked on the strip?

**15** Turn off the recorder. Take the paper out of the recorder, and turn on the recorder again.

What do you see?

**16** What is the maximum number of traces that may now be printed on the strip?

**17** If you have a M1358A US/MECG Combi transducer, or ECG/FSp$O_2$ patient module M1365A, follow the next steps, otherwise skip to Step **21.**

**18** Remove all the transducers from the front panel.

**19** If you have the US/MECG Combi transducer, make sure that it is complete, (the MECG transducer connects to the Y connector on the cable). (This is not the same MECG transducer module as the stand-alone M1359A MECG transducer.)

Plug this transducer into the Cardio 1/Combi socket, and note the front panel display.

**20** Now plug the US/MECG Combi transducer, or ECG/FSp$O_2$ patient module, into the Cardio 2 socket.
What do you see on the front panel display?

**21** How do you adjust the volume and contrast for the maternal measurement display screen.?

**22** Now plug the NBP connector with attached cuff into the NBP socket. Press the NBP key to access the NBP set up screen.
Change the measurement mode from manual to auto, and adjust the time period between each measurement to 10 minutes. See the *Instructions for Use*.

Go to the alarm set up screen, and set diastolic alarming to ON. Change the upper limit to 100.
Can you set alarms for diastolic and systolic measurements simultaneously?

**23** Plug the Sp$O_2$ transducer into the Sp$O_2$ socket.
Set the alarms to on.
Decrease the alarm limit by 1%.

**24** Set the minutes for the Non-Stress Test (NST). Ensure that the recorder is off. Press the recorder ON/OFF key Record for two seconds. Adjust the timer using the + and - keys.

**25** Switch the NST timer off.

**26** The following symbols and markings may be seen on the recorder paper. What does each symbol mean?

You have now completed Section 2. Be sure to check the Course Procedure in the front of this workbook, before going on to Section 3.

3

# Performance Assurance & Service Tool Testing

## References required:

Series 50 XM/XMO (M1350B/C) Service Guide:

- Safety, Maintenance and Calibration.
- Configuring the Monitor.

Remember to check your responses with the answer sheet.

## Questions and Tasks

1 Turn on the fetal monitor. Make sure the paper is loaded in the recorder and turn the recorder on.

2 Refer to the section on Performance Assurance Checks in the *Service Guide*, Chapter Maintenance. Make sure all the transducers have been removed from the fetal monitor. Press the **Test** key.

What do you see on the front panel display and on the recorder paper?

This performs a **Quick Test**. This test checks:

- Lamps.
- LEDS.
- Recorder.
- Internal function.

3 Plug in an Ultrasound, TOCO and DECG transducer. Power on the monitor, push the test key and hold it down for several seconds.

What do you see on the front panel display and on the recorder paper?

This performs the **Parameter Test**, which tests the entire signal processing chain, including:

- The DECG patient module.

– The MECG patient module (if connected).

The transducers themselves are NOT tested.

The system is able to recognize whether a DECG adapter cable (M1362A/B) or a ECG adapter cable (M1363A/B) is connected

*The US and TOCO transducers are NOT tested.*

# Service Software Kit

The service software kit (part number M1360-68875) allows you to carry out various extended configuration and service functions on the fetal monitor. The service software disk can be run on an industry standard PC. There is also an adapter cable to connect the monitor to the PC.

Refer to the *Service Guide*, Configuring the Monitor for details on the PC service software functions.

If you do not have a PC available, go to Section 3 of this course.

4 Set up the PC Service System by connecting the service cable from the COM1 port of your PC to the service connector port on the front of your fetal monitor The service connector is marked as (1) in Figure 1. Follow the instructions in the *Service Guide*, Configuring the Monitor, to ensure that the service software is correctly installed.

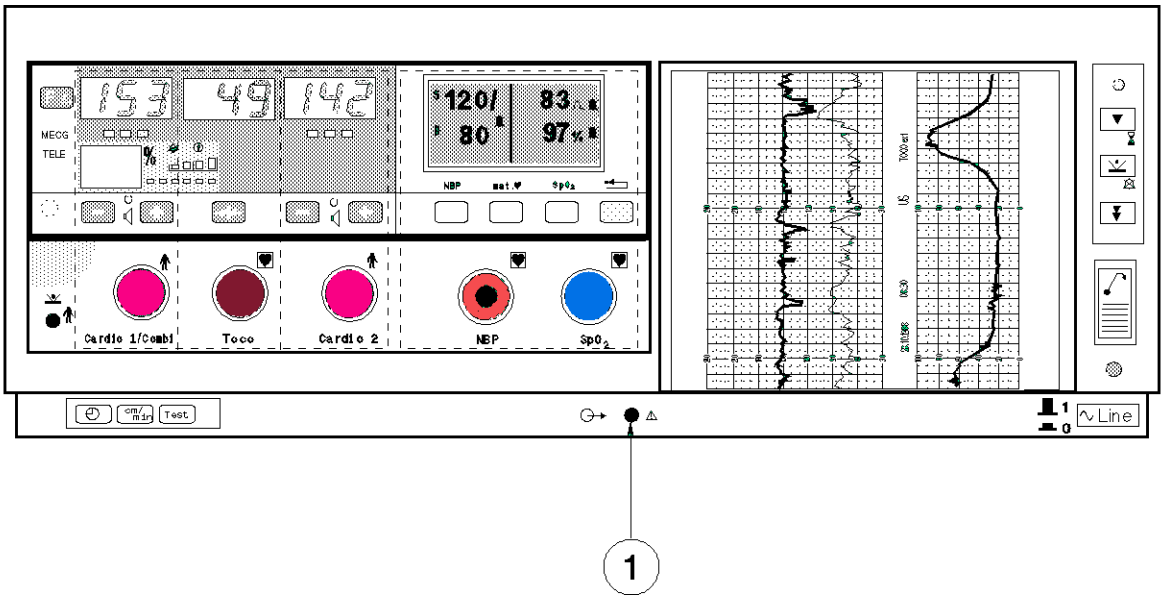



**Figure 1 Position of the Service Connector**

5 Run the **PEGSERV** program. The service Main Menu is displayed.

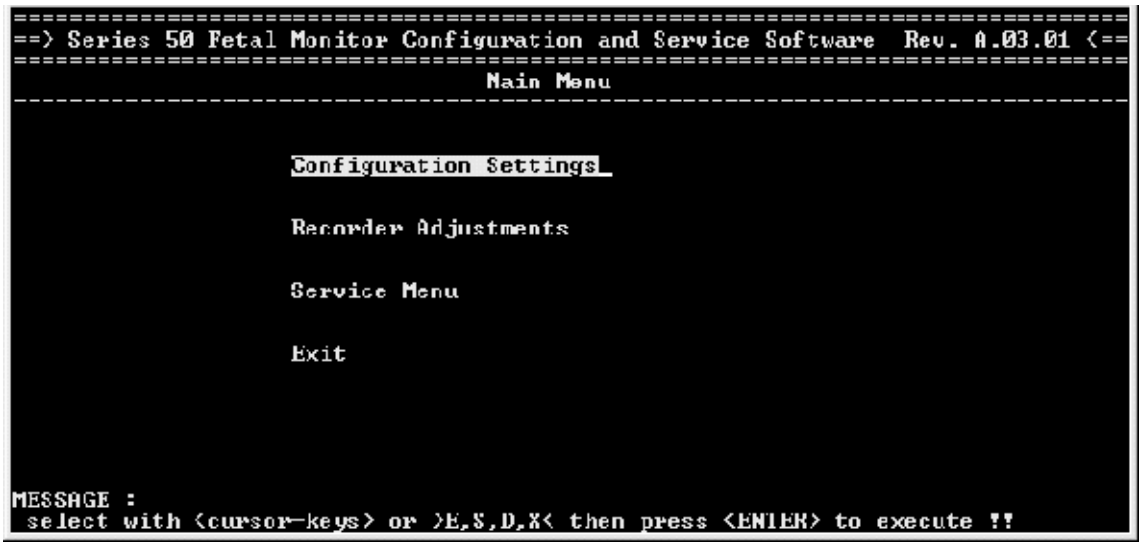

==> Series 50 Fetal Monitor Configuration and Service Software Rev. A.03.01 <==
Main Menu
Configuration Settings
Recorder Adjustments
Service Menu
Exit
MESSAGE :
select with <cursor-keys> or >E,S,D,X< then press <ENTER> to execute !!

**Figure 2 Main Menu**

The configuration settings have been made during installation and should not be changed without the approval of the clinical staff.

You can change the following settings:

- Paper scale.
- Time format.
- Date format.
- IUP scale.

6 Select **Recorder Adjustments** from the main menu.

Adjustments may need to be made after repair of the recorder assembly.

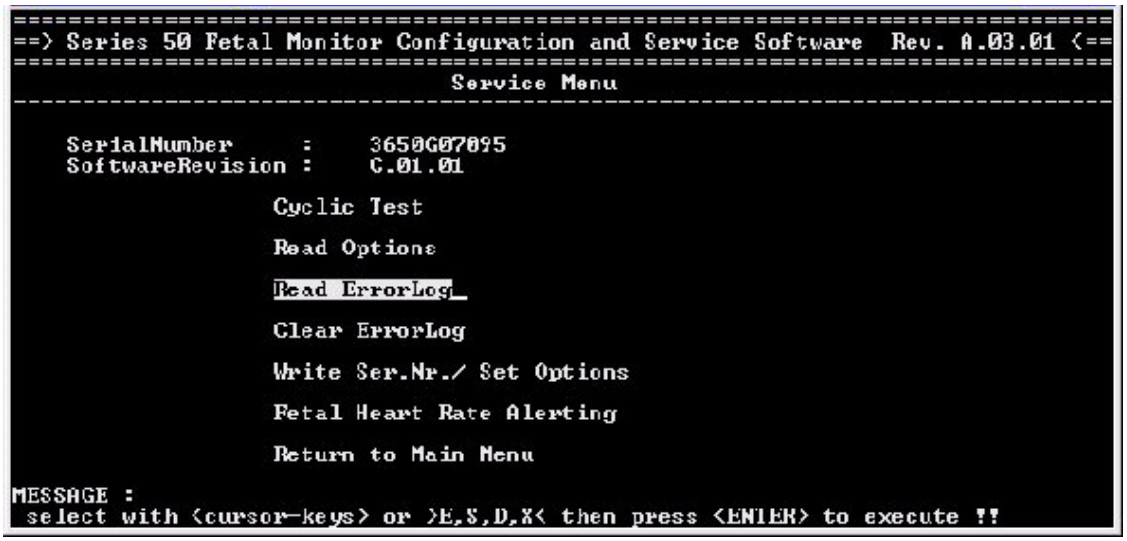
7 With the recorder turned on, run the **Parameter Test,** (remember this test requires the transducers to be connected). The trace on the paper should match the digital readout on the front display panel. Using the cursor controls, move the Recorder Zero Adjust Value and press Enter to set this new value in the monitor. Then, re-run the **Parameter Test** and note how the recorder trace has moved.

8 Readjust the Zero-Adjust for correct recorder print-out.

The thermal print head heat value can be adjusted via the Recorder Heat-Adjust option.

9 Return to the Main Menu.

10 Select the Service Menu.




The serial number of the monitor is the first item on the screen. Where is the serial number stored?

11 Select **Read ErrorLog** . You see:

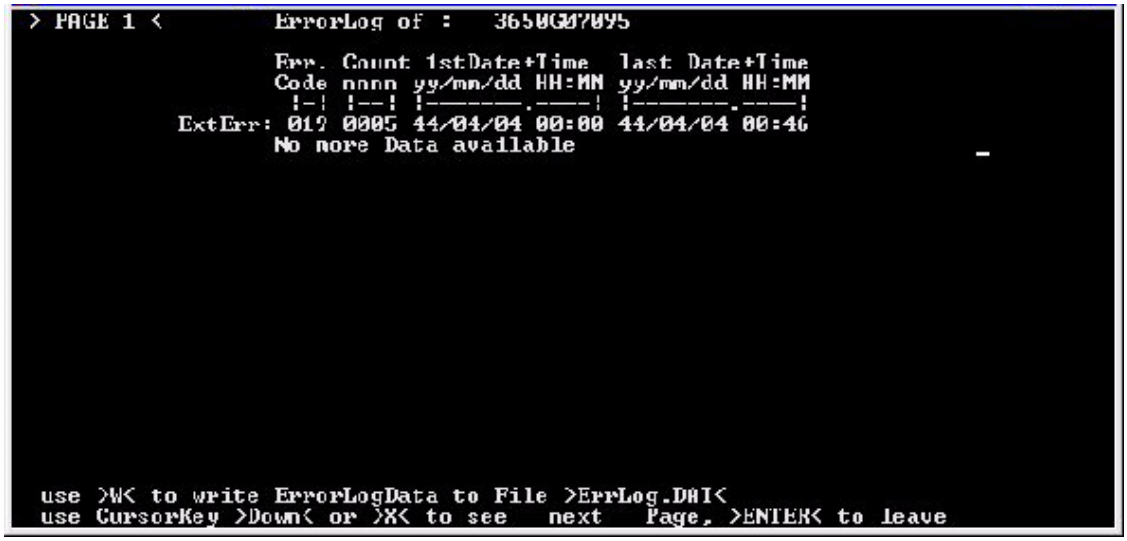



**Figure 3 Read Error Log Screen**

This error log shows:

– The code number.
– How many times the error occurred (this is hexadecimal).
– The date and time of the first occurrence.

– The date and time of the last occurrence.

What would you expect to see on the error log if the battery is removed or before the monitor was switched on?

12 Return to the Service Menu,

In case of intermittent problems, the **Cyclic Test** can be run and left running for an extended period of time. All errors are recorded in the error log, and can be read by exiting the Cyclic Test and selecting `Read ErrorLog`.

13 Return to the Main Menu, then exit from the Service Program and disconnect the service cable.

14 Turn off the monitor. You have now completed Section 3.

Check the course procedure at the front of this workbook before going on to Section 3.

4

# Disassembly and Troubleshooting

**CAUTION** Electrical power is dangerous. The power to the system must be disconnected before you attempt to remove any component from the system.

All of the following service procedures should be performed at an anti-static workstation. You should follow anti-static procedures whenever you remove or handle boards or subassemblies.

## References Required:

Series 50 M1350B/C Service Guide:

- System Interfaces.
- Troubleshooting.
- Removal and Replacement.
- Recorder Disassembly.

Remember to check your responses with the answer sheet.

## Questions and Tasks

1 The M1350B/C comprises of two major assemblies: the chassis assembly and the recorder. Looking at the rear of the monitor, notice the power supply assembly on the left hand side and the cover plates on the right hand side. Cover plates without holes are currently unused slot locations. How many slot locations are there?

2 The line voltage fuses are located under a panel next to the power socket. After removing the power cord, remove the panel using a crosshead screwdriver, and then the fuse.

What is the value of the fuse?

3 Following the disassembly procedure in the *Service Guide*, remove the power supply. Examine the power supply. It comprises of the transformer assembly, and the power supply PCB (PSU).

4 Remove the PSU and locate the two replaceable fuses on it. Detailed information is in the *Service Guide,* "Removal and Replacement Procedures, Rear Assembly section".

5 Look at the connector pins on the PSU. There are 96 pins arranged in three columns of 32 pins each. Column A is closest to the board and Column C is furthest away. These pins can be used to check the power supply voltages. (Details are given in the *Service Guide*, "Troubleshooting, Power Supply section").

6 Reassemble the power supply and replace it in the monitor housing.

When replacing the power supply assembly, hold the Line switch situated on the front of the monitor, as this can be dislodged while inserting the power supply.

DO NOT force the power supply into the rear of the monitor. If it will not locate, remove and check that the pins connecting the supply to the backplane are not bent. Then, re-insert the supply.

7 Look at the slots on the rear panel to the right of the power supply. The number of boards installed depends on the capabilities installed in the monitor. Each board has a red error LED which is illuminated at start up and extinguished when the board passes the **Power On Self-Test**. The error LEDs are controlled by the CPU board which has overall control of the entire system.

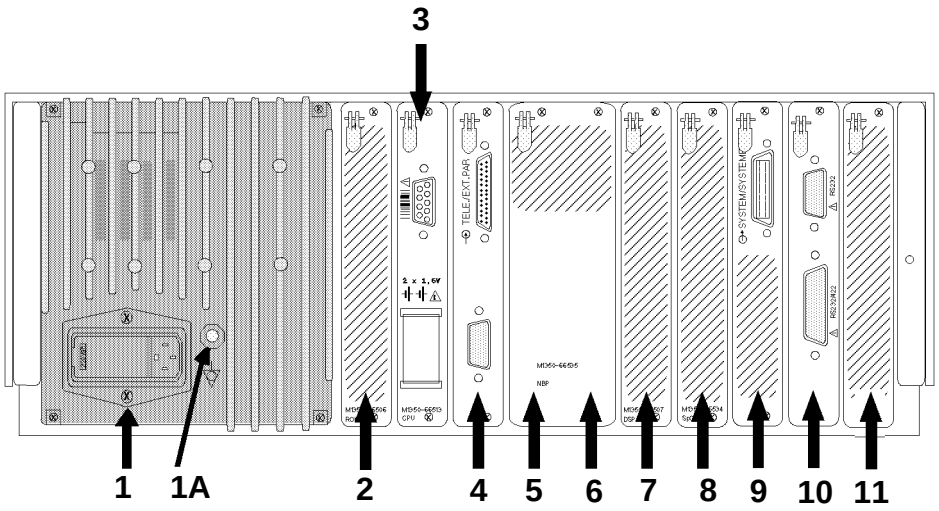



**Figure 4 Rear Panel (Slot Positions)**

Look once again at the monitor. The slots are numbered from *left* to *right as you look at the back of the monitor. Note that the DIF board (M1350-66515) is located in Slot 0 inside the monitor (not visible from the rear). The power supply is in position/slot 1 (the equipotential grounding point is labelled !A). The first left hand slot (position/slot 2) next to the power supply is always occupied and holds the ROM board. There is a red LED on the board which is visible through the slot cover without removing the board.* For further details, see the latest *Service Guide*.

Under normal operation is this LED off or on?

**8** The ROM board (M1350-66506) contains all the system software (except for NIBP, $SpO_2$ and $FSpO_2$ software) which is uploaded to the individual boards during startup. Take out the ROM board by removing the two retaining screws, lifting the tab at the top of the slot cover, and pulling the board towards you. You see 4 EPROMs on the board.

How are they numbered?

**9** Replace the ROM board, and move the next board (position/slot 3). This board is the CPU board (M1350-66513). The CPU board is the master of the system bus, and is directly connected to the ROM board. All device and user settings are stored in the EEPROM on this board. The CPU board also houses the interface for connecting an optional barcode reader, and the battery drawer.

Remove the battery drawer and examine the batteries. The drawer should contain two, 1.5 volt type IEC, LR1 size N batteries. The polarity is clearly shown on the side of the battery holder and the holder is keyed for correct insertion. Replace the batteries.

What do the batteries maintain?

**10** Locate the two LEDs on the CPU board, one red and one green. Under normal operation the green LED flashes. If the red error LED is illuminated there is a problem with the board.

It is possible to run the fetal monitor with a minimum configuration for troubleshooting purposes. This minimum configuration consists of only the ROM and CPU PCBs in the backplane. See the flow diagram for “Error 500, General Failure” in the *Service Guide*, “Troubleshooting”.

**11** Slot 4 holds the Telemetry Interface Connector and System Interface Connector (RS232) (lower) board (M1350-66536) for telemetry. This board is necessary you are using the fetal monitor with a Fetal Telemetry System. It has a secondary purpose in that is allows an external analog signal to be input to the monitor for hardcopy output to the recorder. Details of this capability are found in the *Service Guide*, “System Interfaces”.

**12** When telemetry is in use, do not plug transducers into the front panel. If you do, you get `Err 16`.

**13** Slots 5 and 6 holds the External Blood Pressure (NIBP) board (M1350-66535) if you have model M1350B or M1350C *with* maternal parameters. If you have a fetal monitor without maternal parameters slots 5 and 6 are empty.

**14** Slot 7 holds the Digital Signal Processor (DSP-II) board (M1350-66507) which has overall control of the system signal processing, and processes the first HR channel, either US1, DECG1 or MECG1. If Fetal Movement Profile is installed on the monitor, it is also processed by this board.

**15** Slot 8 holds the Maternal Pulse Oximetry (SpO) board (M1350-66534) if you have model M1350B or M1350C *with* maternal parameters. If you have a fetal monitor without maternal parameters slot 8 is empty.

**16** Slot 9 may hold Option J12, the Analog System Interface (M1350-66532) for connection to Philips OB systems, such as M1370A, 80225A, M1340A. For detailed information refer to the *Service Guide*, "System Interfaces".

**17** Slot 10 may hold Option J13 which is the Dual Serial Interface card. This interface card provides data communication between the monitor and external devices. For detailed information refer to the *Service Guide*, "System Interfaces".

**18** Slot 11 may hold Fetal Oxygen Saturation ($FSpO_2$) board (M1350-66540), if your monitor has this option. Note that M1350B models do not have this option.

**19** With all boards in place, power on the fetal monitor and observe the LED pattern through the rear panel. All LEDs illuminate, then extinguish.

**20** Turn off and disconnect the monitor from the main power supply. Remove the top cover by undoing the two screws on each side of the monitor housing. Slide the cover to the rear and lift off. Looking into the monitor, identify:

- Recorder assembly.
- Front panel assembly.
- Backplane.

**21** The Digital Interface board (M1350-66515) is the board mounted vertically next to the recorder assembly. It provides the interface to the recorder and display subsystems.

**22** Following the recorder disassembly procedures in the *Service Guide*, "Removal and Replacement Procedures", remove the recorder from the monitor housing.

When disconnecting the orange flat cable from the digital interface board, gently pull on the white connector (do not pull off). The flat cable will be released from the connector which remains on the board.

The two screws accessed through the holes in the paper tray should not be fully removed. They are held in place by the rubber "O" rings. *If a screw is fully removed, make sure you find the "O" ring before you*

*reassemble the recorder*. The recorder is removed by lifting it up to lift the screws clear, and then back towards the power supply and out.

What is the purpose of the black plastic rod on the right hand side of the recorder assembly?

**23** Notice the long silver flat bar with the cable connector running along the top of the recorder assembly. This houses the thermal line printer head (TLPH). Remove the TLPH following the instructions in the *Service Guide*, "Recorder Assembly and Disassembly, Replacing Specific Items" section. The test pattern printed during the Thorough Instrument Test indicates any problem with the printhead.

This is the most common repair to the recorder assembly, and this training session does not proceed any further with the disassembly procedure. Complete recorder disassembly instructions are provided in the *Service Guide*, "Recorder Assembly and Disassembly".

When disassembling the recorder, remember it is a delicate mechanical assembly containing many plastic parts. Do not exert undue strain or pressure which may bend or snap components. Take care with the springs, as these are easily damaged.

During reassembly make sure that the paper eject rod correctly seats with the front panel button. Do not forget to reconnect the grounding straps.

Do not replace the recorder in the monitor housing. It must be removed before the front panel assembly.

**24** Behind the front panel indicators and switches are two boards, the Display Assembly (M1350-69201/69203/69206/69205) housing all the lamps, and the Recorder Keys Switch Assembly (M1350-66521) housing the recorder ON/OFF, page advance, and event marker keys. You can remove both of these boards without further disassembly.

**25** You must remove $SpO_2$ cable and NIBP connector tubing before you can remove the front panel assembly. Remove the cable and connector tubing following the instructions in the *Service Guide*, 'Removal and Replacement Procedures, $SpO_2$ Cable and NIBP Connector Tubing".

**26** The front panel assembly comprising of the Digital Interface board (M1350-66515), the Frontend board (M1350-66517), and the Front Panel (M1350-40202) can be removed as one subassembly. Remove the front panel assembly as described in the *Service Guide*, "Removal and Replacement Procedures", noting that the angle brackets remain with the front panel during removal.

**27** Remove the front panel (cover) from the rest of the front panel assembly by unscrewing the angle brackets and the two screws through the plastic connector panel. You now have access to the front input connectors. These can be unsoldered and replaced (Red Connector part number 1252-3461, Brown Connector part number 1252-3462), although recommended procedure is to replace the entire Front end board.

**28** You are now able to separate the Digital Interface board from the Front Panel board.

None of these boards require any adjustments or calibration.

**29** Reassemble in reverse order, referring to the Service Guide, Chapter 12 as necessary. Then run a Performance Assurance Test (*Service Guide*, Safety, Maintenance and Calibration).

**30** Under normal operation, which LEDs would you expect to see lit?

**31** As well as error LEDs, there are error messages to assist troubleshooting. There are four types of error messages which may appear on the front display. For detailed information refer to the *Service Guide*, "Troubleshooting".

a. The first set, `Err 1` through `Err 16` indicate that the wrong transducers have been plugged in. `Err 101`, `Err 102`, `Err 103` and `NOP` indicate that the patient modules or sensors are defective or incorrectly plugged in. These messages remain on the display until corrected.

b. The second set, `Err BAT` is displayed for 10 seconds only, after power on, but does not prevent the monitor from operating. This error is known as a soft error, and causes the symbol and to be printed on the trace every 10 minutes.

c. `Err PAP 30-240` and `Err PAP 50-210` indicate that the wrong type of paper has been loaded. This causes the symbol to be printed every 3 pages. The errors are also recorded in the Error Log as `Err 602` and displayed as `Err PAP`.

d. The fourth set, `Err 18`, `Err 19`, `Err 601`, `Err 602` and `Err 500` through `540` are recorded in the error log, displayed on the LED and printed.

`Err 19` indicates low battery. It is recorded as `Err 19` in the error log and the low battery sign is displayed.

`Err 18` indicates that the wrong type of paper is being used. there is no LED display error message, but `Err 18` is recorded in the error log.

`Err 602` is recorded in the error log if the wrong paper type is used (`Err PAP`).

`Err 601` is recorded in the error log if the paper speed is incorrect.

When `Err xxx` is displayed, the digits refer to the last three digits of the problem board (for example `Err 515` refers to the Digital Interface board M1350-66515). `Err 500` is an unspecified system error.

How is the **Parameter Test** invoked?

**32** If you suspect a problem with the power supply, what is the easiest way to test it?

33 The following shows the M1350C system block diagram to help you review the complete fetal monitor system.

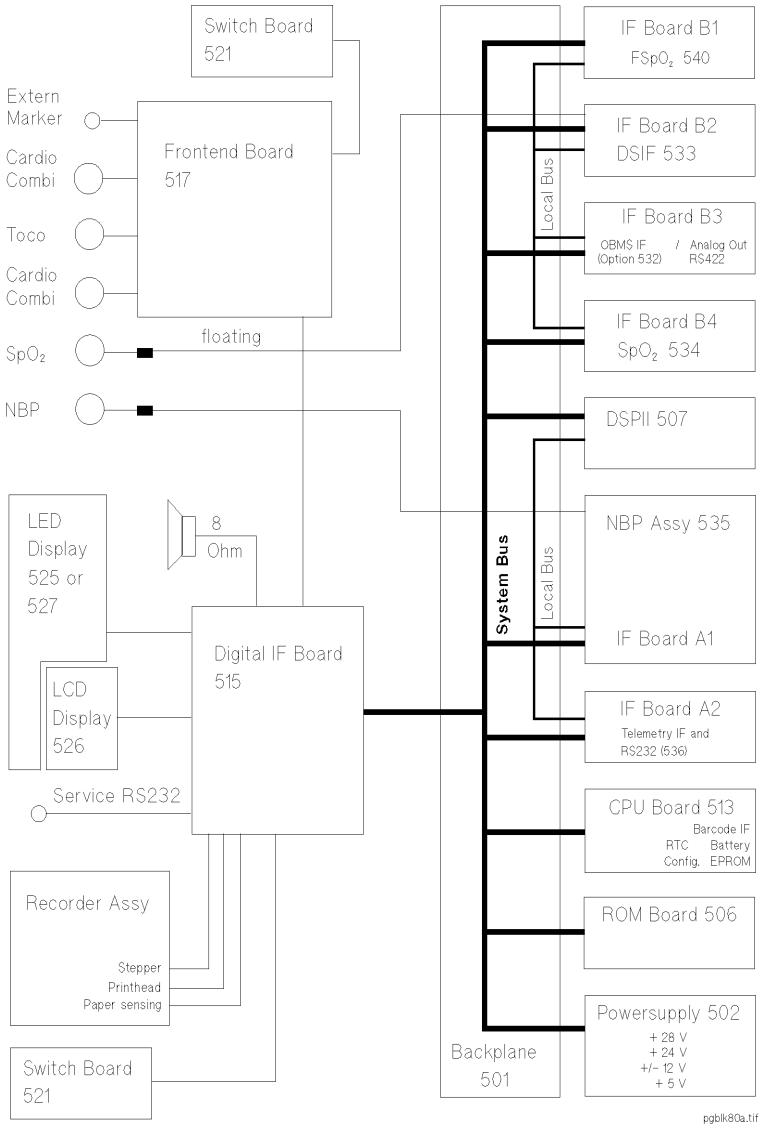



**Figure 5 System Block Diagram**

You have now completed the Section 4. Check the course procedure in the front of this workbook, then go to Section 5.

# 5

# Transducers and Patient Modules

**References Required:**

- Series 50 XM/XMO (M1350B/C) *Instructions for Use:*
  - Care and Cleaning.
- Series 50 XM/XMO (M1350B/C) *Installation and Service Manual:*
  - Transducers and Patient Modules.

Remember to check your responses with the answer sheet.

## Available Transducers and Patient Modules

A number of transducers and patient modules are available for use with the M1350B/C Fetal Monitor. These are[1]:

- M1355A TOCO transducer.
- M1356A Ultrasound transducer.
- M1357A DECG transducer.
- M1358A US/MECG Combi transducer.
- M1359A MECG transducer.
- M1364A ECG only patient module.
- M1365A $FSpO_2$/ECG Combined patient module.
- 1290C IUP transducer.
- CPJ840J5 IUP transducer.
- M1191A $SpO_2$ finger transducer.
- M1190A $SpO_2$ adult sensor
- M1192A $SpO_2$ small adult sensor
- M1194A $SpO_2$ clip (ear sensor)

Minor repairs may be carried out on some of these transducers. Unless obvious physical damage has occurred to the transducers, do not begin repair before running a Parameter Test. This checks that the monitor is able to process signals from the transducers and helps eliminate the monitor as a source of the problem.

1.There are other transducers and sensors available, including disposable ones. Contact Philips for details.

# Questions and Tasks

1 TOCO Transducer. ONLY **brown** (older) transducers can be repaired.

All **blue** transducers are sealed, watertight units and are **NOT** repairable. Replacing the cable of a **blue** transducer, or modifying the transducer in any way, will void any warranty, including the guarantee of watertightness. In case of malfunction or damage, exchange the transducer.

If the fetal monitor is unable to recognize the TOCO transducer there may be damage to the connector. The connector contains a resistor which is sensed by the Frontend board. For brown transducers, replace the cable complete with the connector as described in the *Service Supplement M1350-9300A*, *Replacement Transducer Cables*. The connector of the TOCO transducer is not sealed, allowing air exchange with the transducer to compensate temperature changes, and therefore should not be immersed in fluids. If the transducer does not appear to respond to pressure changes, there may be damage to the strain gauge.

Take particular care with the transducer seals. It is important to prevent moisture seepage, during disinfection for example, as this causes corrosion and possibly causes the strain gauge to stick. If, when opening the transducer, you find evidence of corrosion, you should check that the recommended Philips sterilization process is being followed as outlined in the *Instructions for Use*, “Care and Cleaning”.

2 IUP Transducer (CPJ840J5 or 1290C). This transducer is disposable, and it is not repairable.

3 Ultrasound Transducer. ONLY **brown** (older) transducers can be repaired.

All **blue** transducers are sealed, watertight units and are **NOT** repairable. Replacing the cable of a **blue** transducer, or modifying the transducer in any way, will void any warranty, including the guarantee of watertightness. In case of malfunction or damage, exchange the transducer.

With the ultrasound transducer plugged into the fetal monitor, and with the appropriate loudspeaker active, move your hand towards and away from the transducer head and listen for a "whooshing" sound from the loudspeaker. If there is no sound, replace the transducer. If you are not sure if the transducer sounds good, check the crystals.

The Ultrasound transducer contains seven transmit/receive crystals. Damage can occur to individual crystals and degrade performance. Hold a pen over each crystal in turn and move it towards and away from the transducer head. You should be able to hear the detected motion from the loudspeaker. If one or more crystals is defective, replace the transducer. If the connector only is damaged, it is possible to replace the cable assembly (**brown** transducers ONLY), but be careful when handling the delicate crystal board, and avoid damage to the seals when reassembling.

4 DECG Transducer (M1357A) and ECG only Patient Module (M1364A). The transducer is an active transducer which contains the DECG processing circuitry. The head is sealed and cannot be repaired.

5 US/MECG Transducer (M1358A) and MECG Transducer (M1359A). The MECG transducer is a molded unit and cannot be repaired.

6 $SpO_2$ Transducer (M1191A). The $SpO_2$ transducer is a molded unit and cannot be repaired.

7 Patient Modules (M1364A and M1365A). Both patient modules have a 7-pin ECG connector into which you can plug either DECG cable (M1362A/B) or MECG cable (M1363A). The $FSpO_2$ combined patient module also has a 9-pin connector for the fetal oxygen sensor.

You have now completed section 5. Proceed to Section 6.

6

# Monitor Settings and On-site Monitor Configuration

## References Required:

- Series 50 XM/XMO (M1350B/C) *Service Guide*.
  - Configuring the Monitor.
- Series 50 XM/XMO (M1350B/C) *Instructions for Use*.
  - Monitoring FHR and FMP using Ultrasound.
  - Monitoring Twin FHRs.

## M1350B/C Settings

Several of the M1350B/C settings can be configured to better meet user and support requirements.

## Questions and Tasks

### Barcodes

Two settings can be switched on or off using barcodes:

- Fetal Movement Profile (FMP) ON/OFF. For further information refer to the chapter "Monitoring FHR and FMP Using Ultrasound" in the *Instructions for Use*.
- Separating FHR Trace by an offset of 20bpm. For further information refer to the chapter "Monitoring Twin FHRs" in the *Instructions for Use*.

### Barcodes and Front Panel Push-button

You can select the following settings using barcodes *or* front panel push buttons. For details, refer to the *Service Guide*.

**Table 1**

| Setting | Menu Number |
|---|---|
| Time Format (24:00 or 12:00 AM/PM) | C01 |
| Date Format (mm.dd.yy or dd.mm.yy) | C02 |

**Table 1**

| Setting | Menu Number |
|---|---|
| IUP Scale (mmHg or kPa) | C03 |
| Paper Scale (50-210 bpm or 30-240 bpm) | C04 |

## Front Panel Push-buttons

You can select fifteen additional settings (menu numbers C05 through C20) using push-button *only*. These settings are listed in the *Service Guide*, Configuring the Monitor, section Configuring the Monitor Using Push-button.

1 Switch on the fetal monitor, make sure that paper is loaded in the recorder and turn the recorder on.

2 Switch on the fetal monitor, make sure that all transducers are disconnected from the monitor. While pressing F ⚠ key, simultaneously press the Test key.

3 What do you see on the front panel display?

4 Press the F ⚠ key again to select the monitor function.

**C** in the far left display location stands for configuration.

**A** stands for activity.

5 Toggle the F ⚠ key to select the configuration or activity function.

6 Press the + volume key to change the menu number. The - volume key allows you to step backwards through the menu.

7 To initiate a configuration or activity setting, you need to press the TOCO offset key.

How do you save any settings you have changed?

8 Make a note of the default date format for your fetal monitor printed on the recorder strip. Change the format by pressing F ⚠, Test , + and TOCO offset keys. Remember that the date format is menu number C02.

Make sure you reset the fetal monitor to its original format after the exercise.

9 Print out the ERROR LOG using the menu A01. What sort of information is available on the print out? (For more information refer to the *Service Guide*, “Configuring the Monitor, Printing and Clearing the Error Log”).

10 Clear the ERROR LOG (menu number A02).

11 If a barcode reader is available, change the monitor feature settings by running the barcodes in the barcode booklet (M1350-9071C), supplied with the barcode reader.

12 Go to Activity menu A03. Connect an Ultrasound, TOCO, and DECG transducer. Press the external Event Marker. Keep the external Event Marker pressed (by using adhesive tape), and press the TOCO offset key.

**13** What happens?

You have now completed the Section 6. Check the course procedure in the front of this workbook, then go to Section 7.

7

# Upgrades

## References required:

Series 50 XM/XMO (M1350B/C) *Service Guide*:

– Chapter 7, “Upgrades”.

## Steps

There are many different upgrades possible. Refer to the *Service Guide*, “Upgrades, Overview of Upgrade Options” for a list of upgrade options.

If you have a monitor that you can upgrade and the appropriate options to upgrade it, follow the steps in this section together with the instructions described in the *Service Guide* to upgrade your monitor.

If you do not have a monitor to upgrade, go through the steps in this section, referring to the *Service Guide* where necessary, and answer the questions. Doing this will provide you with a basic understanding of the upgrade process. Skip the sections that require you to physically upgrade a fetal monitor.

Remember to check your responses with the answer sheet.

## Questions and Tasks

1 Prepare the monitor for upgrade. See *Service Guide*, Chapter 8, “Upgrades”, Instructions 1, 2 and 3 if you need more information.

– Check the monitors serial number.

– Ensure that the monitor works correctly. Perform the **Parameter Test** and the **Quick Test**.

– Check the current configuration. How do you do this?

– Remove the top cover.

2 If you have a monitor to upgrade make sure you have completed all the procedures described in instructions 1, 2 and 3 in the *Service Guide*, Upgrades. If not, go to step **3** in this section.

3 List which parts you can re-use with a new base assembly.

4 Which boards can you swap out of the original monitor into the new monitor?

5 If you have a monitor to upgrade follow instructions 4 and 5 in the Service Guide, Upgrades, then go to step **6** in this section. If not go to step **8** in this section.

6 If available add NIBP and $SpO_2$ capability to your fetal monitor.

7 If available, add an $FSpO_2$ board.

8 How is the fetal monitor firmware upgraded?

If possible, (that is if you have a monitor to upgrade and the parts required), follow instruction 8 in the *Service Guide*, and upgrade the firmware. If you have no monitor to upgrade you have finished this section. Check your answers at the back of this workbook.

**Do not forget to perform the appropriate safety test, and initiate the monitors self test before using the monitor on a patient!**

9 If you exchange the CPU board you must rewrite the new serial number and restore the original options configuration. Enter the old serial number from the serial number label. This must be done using the service software. See *Service Guide*, "Configuring the Monitor", for more information.

Remember that a serial number can only be written once to the exchanged board.

10 To reset all the option settings to default options, switch the monitor off and remove the batteries for at least two minutes.

11 Perform the appropriate test/inspection and safety procedures. Refer to the *Service Guide,* "Upgrades", for more information.

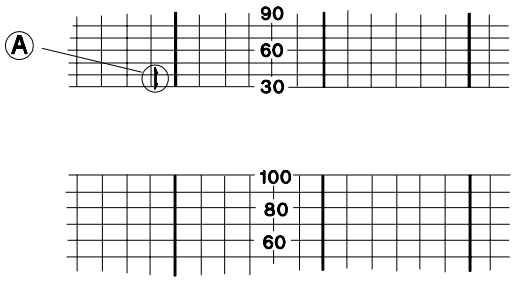
Congratulations! You have now completed the course. Now take time to watch the *M1350B/C Fetal Monitor Video Operating Guide* video tape again, review this workbook, then take the course exam.

8

# Workbook Answers and Explanations

## Section 2 Operation

| Question or Task | Answers |
|---|---|
| 2 | Paper is available in two colors; orange and green.<br>Orange denotes a scale on the fetal heart rate (top) portion of 30 to 240 bpm.<br>Green denotes a scale of 50 to 210 bpm.<br>It is important to use the correct paper. Your fetal monitor has been preset to accept one scale, and can be reset via the software service tool (see Service Guide, Configuring the Monitor) or the push buttons. |
| 4 | Three lines appear in each section of the front panel display. |
| 5 | The clock setting mode is exited if no key is pressed for 15 seconds, or if you press the clock key once more after you have set the time and date. |
| 6 | The speed setting key is located on the bottom left corner of the front of the monitor between the clock and the logic keys. |
| 7 | When the recorder is turned on, the time, date, paper speed, and any detected operating modes are annotated on the strip. Error symbols may also be annotated. |
| 8 | Either of the red Cardio sockets. When a single ultrasound transducer is plugged into the monitor, US is lit on the front panel. Traces from Cardio 1/ Combi channel are darker than those from the Cardio 2 channel to be able to distinguish between the two. It is therefore recommended that the Cardio 1/ Combi channel be used when monitoring a single heart rate. |
| 9 | Either of the red cardio sockets may be used. |
| 10 | Logic should only be switched off when monitoring DECG (Direct ECG). This is done in cases of suspected fetal arrhythmia. It allows heart rate changes of greater than +/- 28bpm to be detected. Under normal conditions logic is ON, in which case heart rate changes of more than +/- 28bpm are rejected. |

| Question or Task | Answers |
|---|---|
| 13 | The maximum TOCO reading is 100 for an external transducer. When an Intra Uterine Pressure (IUP) transducer is used a range of -99 to +127 is possible. |
| 14 | A remote event marker can be plugged into a socket on the lower left portion of the front panel of the monitor. A small arrow (**A**) is annotated on the HR scale to mark an event. The arrow starts at a peak to show the exact time when the button is pressed.<br>  <br>Example of Event Arrow on Trace<br>If the button is not released a black bar is printed on the trace. The width of the bar corresponds to the duration the button is pressed. |
| 15 | When the recorder has run out of paper, after a few seconds, the recorder display lamp flashes rapidly. |
| 16 | Up to six traces (FHR1, FHR2, MECG, External Parameter, FSpO2, and TOCO), along with event marks and fetal movement indications. |
| 20 | `Err 4`. The Combi transducer may only be plugged into the Cardio 1/ Combi socket. |
| 21 | The method for changing the alarm volume and the screen display contrast is the same.<br>Display the maternal main screen.<br>Press the reset key and keep it pressed until the setting screen replaces the maternal main screen (about two seconds).<br>Press Volume or Contrast.<br>Press ◄ to decrease the setting.<br>Press ► to increase the setting<br>Press the reset key to return to the maternal main screen.<br>See *User's Guide*, Maternal Monitoring, for more details. |
| 22 | You cannot have both systolic and diastolic alarms active at the same time. |

| Question or Task | Answers |
|---|---|
| 26 | 1. Soft Error. This is printed on the recorder strip to indicate a soft error occurred. The front panel displays the appropriate error message for ten seconds, but the error will not prevent the monitor from operating. The error message can be seen again by turning off the monitor, then turning it back on and observing the front panel.<br><br>Note that not all errors are displayed following power-on. Recorder paper speed errors take up to three pages (or up to 30 minutes) until they are registered, confirmed, and displayed.<br><br>2. Event Mark.<br><br>3. Battery Low.<br><br>4. Questionable Heart Rate Source. This appears if the fetal monitor is monitoring twins by ultrasound only, or maternal heart rate and fetus, and the is unable to distinguish between the source of the signal. This is a result of a cross channel verification algorithm in the monitor |

# Section 3 Performance Assurance & Service Tool Testing

| Question or Task | Answers |
|---|---|
| 2 | At board level, this self test routing causes the red LED of a bad board to light and the last 3 digits of the board's part number to be displayed on the front panel display. The LEDs are visible through the rear panel housing. On the front panel all LED segments are tested. The display alternates between all 8s in the display section `888 888 888` and all indicator lamps being illuminated. Any lamp or LED segment failure is shown through this test. |
| 3 | A reading of 200bpm shows on the DECG display, a reading of 190bpm shows on the US display. The TOCO display toggles between 10 and 60. The signal quality lights are green, and the channel for which the loudspeaker is active beeps. The beep for DECG is different to that for ultrasound. Try switching between the DECG and ultrasound by pressing [+]. The light above the loudspeaker symbol indicates which one is active. On the recorder paper, all active transducer modes are annotated; US (1 or 2, depending on which socket it is plugged into), DECG and TOCO ext. If the fetal movement profile option is installed, FMP is printed on the lower trace. A square wave pattern of amplitude varying between 10 and 60 on the TOCO scale is printed. |
| 10 | The serial number is stored in the EEPROM on the CPU board. If CPU board is replaced, it is necessary to re-enter the monitor's serial number. Once written, a new serial number cannot be overwritten. |
| 11 | One entry `Err 19`. The error log is maintained by the batteries. If the batteries are removed from the monitor when it is not powered on, all previous log entries are lost. |

# Section 4 Disassembly & Troubleshooting

| Question or Task | Answers |
|---|---|
| 1 | There are ten slot locations to the right of the power supply. Note that Slot 0 (holding the DIF board (M1350-66515), is located inside the monitor, and is not visible from the rear. |
| 2 | For a UL monitor operating at 100/120 volts, the fuse is 1 Amp (replacement part number 2110-0007).<br>At 220/240 volts, the fuse value is 0.5 Amp (replacement part number 2110-0548 for IEC regulation monitors).<br>See *Service Guide*, Pre-Installation Checks. |
| 7 | Off. Under normal operating conditions on all boards, the red error LED is off. |

| | |
|---|---|
| 8 | The revision of the system firmware is indicated by the part number. The four EPROMS are numbered 1 and 2 and high and low. If it is necessary to move these to a new board, note their locations carefully |
| 9 | The batteries maintain:<br>The clock.<br>Battery backed RAM containing the Error log. If the batteries are removed, the Error log is erased. |
| 22 | The black plastic rod connects with the paper eject button. It can easily be removed during work on the recorder to prevent accidental breakage. |
| 30 | The green power on LED on the lower right side of the front panel. The green flashing LED on the CPU board which can be seen through the rear panel. |
| 31 | The **Parameter Test** is performed by pressing the test button down with the transducers connected.<br>The **Quick Test** is performed by pressing the test key when no transducers are plugged into the monitor. |
| 32 | Remove the power supply from the monitor housing. Taking suitable pre-cautions, plug it in and perform voltage check measurements. The easiest way to access the test points is via the 96 pin connector on the power supply board. |

# Section 5 Transducers & Patient Modules

No questions set in this section.

# Section 6 Monitor Settings & On-Site Monitor Configuration

| Question or Task | Answers |
|---|---|
| 3 | Front Panel Display<br>C01 1-<br>Refer to *Service Guide*, Chapter 4, Configuration Tasks and Configuring the Monitor Using Push-buttons for a list of menu number and options. |
| 7 | To save the settings, press **Test** or do not press any key for fifteen seconds. After fifteen seconds has elapsed the setting is automatically saved. |
| 9 | The information given on the error log is divided into seven sections.<br>Section 1: error code information (except for $FspO_2$ board).<br>Section 2: all built-in options for the fetal monitor are written.<br>Section 3: details about the monitor (date, software revision, monitor ID).<br>Section 4: information about which boards are fitted.<br>Section 5: the complete configuration service settings.<br>Section 6: revision number of the $FSpO_2$ software.<br>Section 7: $FSpO_2$ board-specific error codes. |
| 13 | The permanent test runs as long as event marker is pressed. |

# Section 7 Upgrades

| Question or Task | Answers |
|---|---|
| 1 | To check the current configuration, print the error log.<br>You need the error log to reconfigure the monitor and restore the original settings, after you have upgraded the fetal monitor. |
| 3 | You can re-use the following parts with a new base assembly:<br>Cover.<br>Power supply,.<br>Recorder.<br>ROM board. |

| Question or Task | Answers |
|---|---|
| 4 | You can swap the following boards out of the original monitor into the new monitor:<br>Telemetry interface.<br>Dual serial interface.<br>OBMS interface.<br>CPU.<br>ROM.<br>DSP. |
| 8 | The firmware you need to upgrade is the EPROMs on the ROM board and if required a new ROM on the NIBP, maternal SpO2 and fetal SpO2 boards. You must remove all the above-mentioned boards and fit the EPROMs onto the boards as appropriate.<br>Do not forget to perform the appropriate safety tests, and initiate the monitor's self-test before using the monitor on a patient.<br>If you are performing upgrade option S01, this is the only upgrade procedure you need to follow. |

9

# Examination Questions

## Candidate Details

**Name:** _____

**Date:** _____

## Questions

1 DECG stands for _____.

2 Which test will verify the operation of the DECG transducer?

3 When do you switch LOG on?

When would you switch LOG off?

4 Error 506 is displayed on the front panel. Which board has probably failed, and what is its part number?

5 You discover a faulty ROM board and suspect that the firmware is corrupt. What replacement board should you order?

6 Complete the following table:

| Name of Board |
|---|
| DSP-II |
| ROM |
| Digital I/F |
| CPU |

| Primary Function | Done by Board... |
|---|---|
| A. System software resides here | |
| B. HR channel 1 processing | |
| C. Master of system bus | |
| D. Interfaces to display and recorder | |

7 The time of day clock must be set each time the fetal monitor is switched on?

| TRUE | FALSE |
|---|---|

8 Where is the line fuse located in the fetal monitor?

9 The ultrasound trace on the recorder paper appears to be very light. Mark which of the below might be possible causes:

a. Ultrasound transducer plugged into cardio 2 socket.

b. Poor quality paper.

c. Thermal printhead needs adjustment or to be replaced.

d. Power supply failure.

10 When monitoring twins via ultrasound, HR1 is fine, but HR2 does not seem to be working properly. First you switch the transducers between input channels, but the problem stays with the ultrasound channel 2. You have now eliminated the transducers as the source of the problem. No red LEDs are visible from the rear panel. What board do you suspect first?

a. DSP-CPU.

b. DSP-CoP.

c. Front end.

d. Digital interface.

11 You get a complaint that is being printed on the paper trace. Does this mean that the trace may not be accurate?

| YES | NO |
|---|---|

12 You get a complaint that is being printed on the paper trace. Does this mean that the trace may not be accurate?

| YES | NO |
|---|---|

**13** How do you run the Quick Test?

**14** A FHR signal of _____ will result from a parameter test with an ultrasound transducer plugged into the cardio 1 socket.

**15** A signal of _____ will result from a parameter test with an ultrasound transducer plugged into the cardio 2 socket.

Total: _____ Pass/Fail:_____

Signature:_____ Date: _____

# Examination Answers

## Marking Information:

The maximum number of correct answers is 15. You must have a total of at least 13 correct answers to pass the examination.

If you have less than 13 correct answers, review the training course, and then take the examination again.

A correct answer is when all parts of the question have been correctly answered.

Answers to questions that are only partly correct do not count.

## Answers

**1** Direct ECG.

**2** NOP.

**3** See *Instructions for Use*, "Monitoring FHR using DECG".

**4** ROM board. Part Number M1350-69506.

**5** M1350-69506.

**6**

| Primary Function | Done by Board... |
|---|---|
| A. System software resides here | ROM |
| B. HR channel 1 processing | DSP-II |
| C. Master of system bus | CPU |
| D. Interfaces to display and & recorder | Digital I/F |

**7** FALSE.

**8** Mains socket.

**9**

a. Ultrasound transducer plugged into cardio 2 socket.

b. Poor quality paper.

c. Thermal printhead needs adjustment, or needs to be replaced, or cleaned.

**10** c. Front end.

**11** NO.

12 NO.

13 Press the **Test** button (with transducers unplugged).

14 190 bpm.

15 200 bpm.